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Indian Standard

CODE OF PRACTICE FOR FUMIGATION OF AGRICULTURAL PRODUCE

PART I METHYL BROMIDE

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INDIAN STANDARDS INSTITUTION
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Indian Standard

CODE OF PRACTICE FOR FUMIGATION OF AGRICULTURAL PRODUCE

PART I METHYL BROMIDE

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*Indian Standard*CODE OF PRACTICE FOR
FUMIGATION OF AGRICULTURAL PRODUCE

PART I METHYL BROMIDE

0. FOREWORD

0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 12 March 1974, after the draft finalized by the Storage and Marketing Structures for Agricultural Commodities Sectional Committee had been approved by the Agricultural and Food Products Division Council.

0.2 Use of fumigants becomes necessary for pest control in various commodities including agricultural produce. Fumigants are, however, effective only under airtight conditions and, therefore, airtight condition is a pre-requisite for carrying out the fumigation. Further it is necessary to choose the fumigant taking into consideration the likely reaction of the fumigant with the material to be fumigated possible hazards to the operators, the area where the fumigation is to be carried out, and the time available for effecting fumigation. For the fumigation operation not only the operators who are actually going to carry out the fumigation are required to be trained, but they should be fully conversant with the various implications of the operation proposed to be carried out.

0.3 A series of Indian Standards is, therefore, being issued covering the selection, safety, and suitable application techniques of various fumigants. This standard covers methyl bromide. It is hoped that adoption of these standards by storage units and export inspection agencies, both in the public and private sector, will promote efficiency, economy and safety.

1. SCOPE

1.1 This standard (Part I) describes general properties, dosage, duration of exposure, precautions in handling and method of fumigation with methyl bromide for pest control in stored agricultural produce and inputs.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS:6151 (Part I)-1967* shall apply.

*Storage management code: Part I Terminology.

3. GENERAL DESCRIPTION AND PROPERTIES OF THE FUMIGANT

3.1 Methyl bromide is a highly poisonous, colourless, mobile liquid and a gas at ordinary temperatures. It is chemically stable, non-explosive, free from fire risks and highly toxic to a wide range of insects including all common storage insects in all stages of development. It has a deep penetrating power enabling it to penetrate grains and flour in bags and such other packs. Its vapours can easily penetrate into cracks, crevices and all hiding places of insects and rodents. Fumigation with methyl bromide can be undertaken with gas-tight covers, rubberised tarpaulins or in airtight chambers or stores.

3.2 Properties

Chemical formula	CH ₃ Br
Molecular weight	94.94
Boiling point	3.6°C at 760 mm Hg pressure
Freezing point	- 93°C
Specific gravity of liquid	1.732 at 0°C
Specific gravity of gas	3.27 at 0°C (that is, ranging between 3.29 to 3.5 at ordinary temperature)
Vapour density	3.956 kg/m ³
Limits of flammability in air	13.5 to 14.5 (nonflammable)
Volume per kg	577.36 ml
Mass per litre	1.732 kg
Amount required to saturate 1 000 m ³ at 25°C	3.88 kg
Odour	Characteristic mild odour
Solubility in other solvents	Readily soluble in mineral oils
Corrosive action	Caustic to skin
Penetration power	High
Colour of vapour	Colourless
Detection of gas	By halide lamp

4. DOSAGE AND EXPOSURE PERIOD

4.1 The recommended dose of methyl bromide for fumigation of agricultural produce and seeds is 22 g/m³ with exposure period of 48 hours under normal atmospheric conditions. If it becomes necessary to complete the fumigation operation within 24 hours, the dosage recommended for normal conditions be increased by 50 percent. When temperature is likely to be below 10°C, the exposure period shall not be reduced below 48 hours.

5. MATERIALS TO BE FUMIGATED

5.1 Methyl bromide may be employed with advantage for fumigation of cereals, pulses, fresh fruits and vegetables and similar other agricultural commodities. There is no danger in fumigating commodities rich in fat with methyl bromide. Milled products and dry fruit rich in protein should not be, however, fumigated with methyl bromide until it is made sure that there is no development of taint and the residue left behind is free of hazard. Seed material shall not be fumigated with methyl bromide if the moisture content exceeds 13 percent.

6. AVAILABILITY

6.1 Methyl bromide which may be 100 percent methyl bromide of technical grade or methyl bromide containing 2·0 percent chloropicrin as a warning agent is supplied in the following two types of containers. The chemical to be used for fumigation shall conform to IS:1312-1967*.

6.1.1 Steel Cylinders — The cylinders have siphons and at normal temperatures the natural vapour pressure of the fumigant is sufficient to discharge from the cylinder. When large quantity is needed it may become necessary to keep the cylinder in the sun while discharge is in progress.

6.1.2 Cans — Small capacity cans are available with copper or plastic tubing. Once a can is opened, it should be completely emptied, because it cannot be resealed.

7. FUMIGATION IN GODOWNS

7.1 Equipment

7.1.1 Gas-Proof Covers with Rings Attached to Facilitate Working of Pulley and String Arrangements

7.1.2 Pulley and Strings

7.1.3 Methyl Bromide Cylinders or Cans

7.1.4 Halide Leak-Detectian Lamps

7.1.5 Gas Mask with Spare Canisters Suitable for Organic Vapours

7.1.6 Can Applicators

7.1.7 Sand Snakes and Mud Plaster for Pasting Round the Edges of the Cover

7.1.8 First-Aid Kit

*Specification for methyl bromide (*first revision*).

7.1.9 Ladder

7.1.10 Weighing Scale or Beam Balance

7.1.11 Adapter Key for the Cylinder

7.1.12 Ancillary Equipment like Rubber Tubes, 'T' and 'Y' Joints, etc

7.2 Method of Application

7.2.1 Cover the stacks to be fumigated with gas-proof covers. Make the cover perfectly airtight by sand snakes. Check the covers for any possible leakage before undertaking the fumigation.

7.2.2 The operators shall wear the gas-mask and rubber gloves before starting the fumigation work. The respirator canisters shall be discarded after only one exposure of this fumigant or after a service life of two hours cumulative exposure, whichever is earlier.

7.2.3 Introduce the gas from the cylinder or the can directly through a rubber or plastic tube by connecting one end of the tube to the cylinder or the can and inserting the other end into the central inlet tube of the cover on the top. Place the methyl bromide cylinder on a platform weighing scales or beam balance and introduce the required dose by opening the cylinder valve slowly.

7.2.4 Test the leakage of the gas, if any, from the cylinder or cover by means of the halide lamp. Green flame indicates presence of bromide vapours.

Note — Although methyl bromide is nonflammable, it breaks down quickly into hydrobromic acid in presence of a flame. The acid is highly corrosive to metals and destructive to plants and plant materials. The space shall not, therefore, be warmed by heaters during fumigation.

7.2.5 Aeration — After the exposure period of 24 to 48 hours, open all the windows and doors of the storage structure for aeration. A halide lamp should be used to ascertain the completion of aeration. Green flame will indicate presence of bromide vapours. After the exposure period of 48 hours, partially remove the cover allowing the fumigated material to air for 2 to 3 hours. At the time of complete removal of the cover, the halide lamp should be used for detecting presence of vapours. The operators removing the covers shall wear gas-mask. After 2 to 3 hours pull up the covers by means of pulleys and strings. Leave the cover on the top of the stack for 6 to 8 hours to allow the vapours to escape.

7.2.6 Gas-Mask — Before use, the gas-mask shall be tested for airtightness. It shall be thoroughly cleaned after use.

7.2.7 Canister — It is of utmost importance to ensure that the canister used is of the right type and is not damaged or has not exposed out its life. Black canisters (with orange stripes) are to be used for methyl bromide.

8. PRECAUTIONS

8.1 Fumigation with methyl bromide should be undertaken only by responsible and technically competent persons who should have a working knowledge of the nature of the gas. No untrained persons should handle this fumigant. The threshold limit for 8-hour daily exposure in 5-day week is 0.3 ppm.

8.2 The cylinders of the fumigant should be kept in a ventilated room and should be checked for leakage from time to time. Hissing noise may be associated with leakage.

8.2.1 The fumigant should be stored and transported only in the supplier's cylinders and the dosage for an operation should be applied directly from these cylinders taking care that their valves are operated with minimum force and that outlets are kept clean and undamaged.

8.2.2 The outlets of the cylinders should remain capped and valves should be protected. The valve head may be slightly oiled when the cylinders are stocked.

8.2.3 The fumigant should never be stored in cylinders containing any appreciable amount of metallic aluminium.

8.3 Since the gas has a very faint odour, its leakage is not easily detectable. No reliance should, therefore, be placed on smell for detection of the gas.

8.4 Contact with the liquid fumigant or its spillage on clothings should be avoided.

8.5 The permissible limit of the residues of the fumigant in cereals and pulses is 50 ppm as inorganic bromide.

9. SYMPTOMS OF POISONING AND FIRST-AID MEASURES

9.1 Symptoms of Poisoning — Possible symptoms of methyl bromide exposure are as given in **9.1.1** to **9.1.2**.

9.1.1 Early symptoms of serious methyl bromide poisoning are malaise, headache, disturbance of vision, nausea, and vomiting. As the exposure is usually through the respiratory tract, pulmonary oedema may commonly occur. It is also possible that the onset of symptoms may be delayed and the total period may be 24 to 48 hours after exposure.

9.1.2 Most of the symptoms of chronic or low-grade methyl bromide poisoning in man are related to the central nervous system with the exception of frequent skin irritation. Disturbance in speech, gait and mentation are common. Sometimes complicated neurological abnormalities may also occur.

9.2 First-Aid Treatment

9.2.1 At the first sign of any of the above symptoms, the following first-aid treatment should be given:

- a) Remove the patient to fresh air and keep him warm;
- b) Remove contaminated clothing;
- c) Do not administer alcohol;
- d) Call physician or take the person to a physician; and
- e) Administer oxygen, if available.

9.2.2 In case, somebody complains of illness due to exposure, it is advisable for the entire crew of men on fumigation job working under the same conditions to stop work immediately. The affected operator should be treated as mentioned above. Further, he shall not carry out fumigation work until he has received the approval of the physician.

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- 602-1955 Code of practice for construction of *MORAI* type rural food grain storage structure
- 603-1960 Code of practice for construction of underground rural food grain storage structure
- 607-1971 Code of practice for construction of bagged food grain storage structures (*second revision*)
- 609-1955 Code of practice for improvement of existing structures used or intended to be used for food grain storage
- 631-1961 Aluminium food grain storage bins
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- 1787-1961 Layout for regulated market yards for fruits and vegetables
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- 5503 (Part I)-1969 General requirement for silos for grain storage: Part I Constructional requirements
- 5503 (Part II)-1969 General requirements for silos for grain storage: Part II Grain handling equipment and accessories
- 5606-1970 Steel bins for grain storage
- 5826-1970 Constructional requirements for flat storage structures for grain (capacity above 200 tonnes)
- 6151 (Part I)-1971 Storage management code: Part I Terminology
- 6151 (Part II)-1971 Storage management code: Part II General care in handling and storage of agricultural produce and inputs (*superseding IS: 610-1955 and IS: 611-1955*)
- 6201-1971 Constructional requirements for flat storage structures for grains (100—200 tonnes capacity)
- 6663-1972 Method for determination of angle of repose of grains
- 7247 (Part I)-1974 Code of practice for fumigation of agricultural produce: Part I Methyl bromide
- 7247 (Part II)-1974 Code of practice for fumigation of agricultural produce: Part II Ethylene dibromide
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